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# *Will Nuclear have a role in Ireland ?*



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Dublin - 1<sup>st</sup> Nov 2007

by Bruno Comby

Independent scientist,  
Founder and President of EFN  
(Environmentalists For Nuclear Energy)



# Photo of the world at night

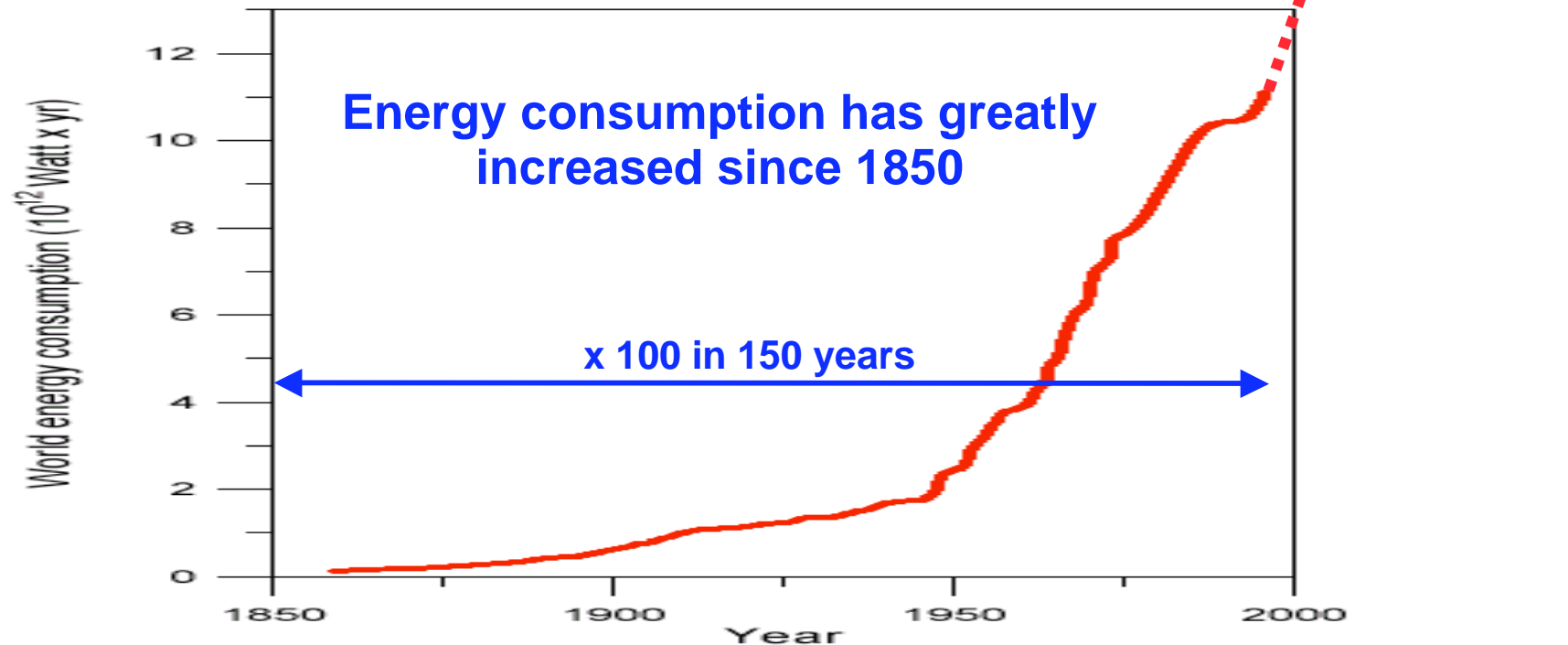
**Today, 20% of the world's population  
consumes 60% of the energy**

Planet Earth seen at night from outer space (reconstructed image) - © Nasa 2000



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# World Energy Consumption since the Industrial Revolution



Today, energy consumption is increasing rapidly in developing countries, and moderately in industrial countries.



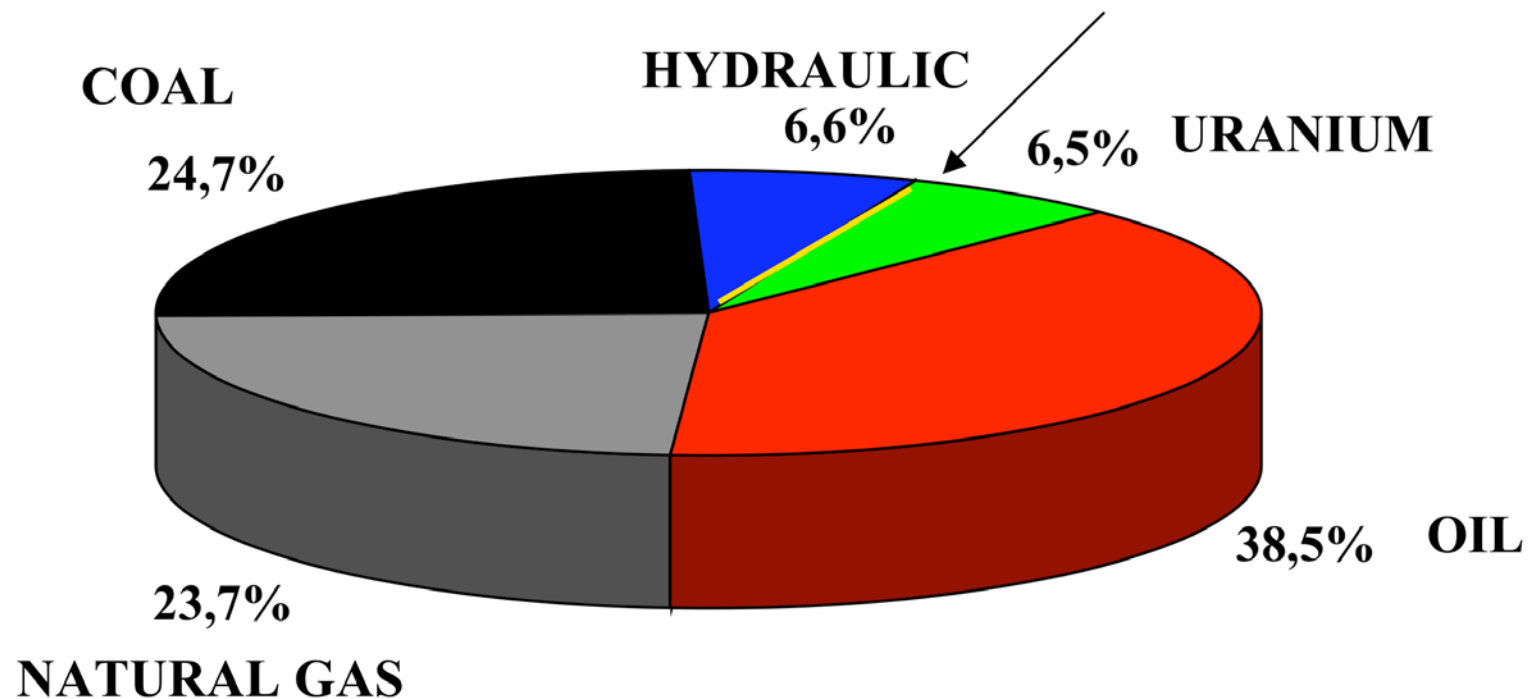
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# ENERGY SOURCES

excluding biomass - fire wood (world 2002)

**87% of the energy is fossil (coal, oil, gas)  
and contributes to the greenhouse effect**

**Wind + geothermal +  
solar = less than 1%**



**9,1 Gtoe/yr + biomass  $\sim$  10 Gtoe/yr**

**Source : BP 2002**

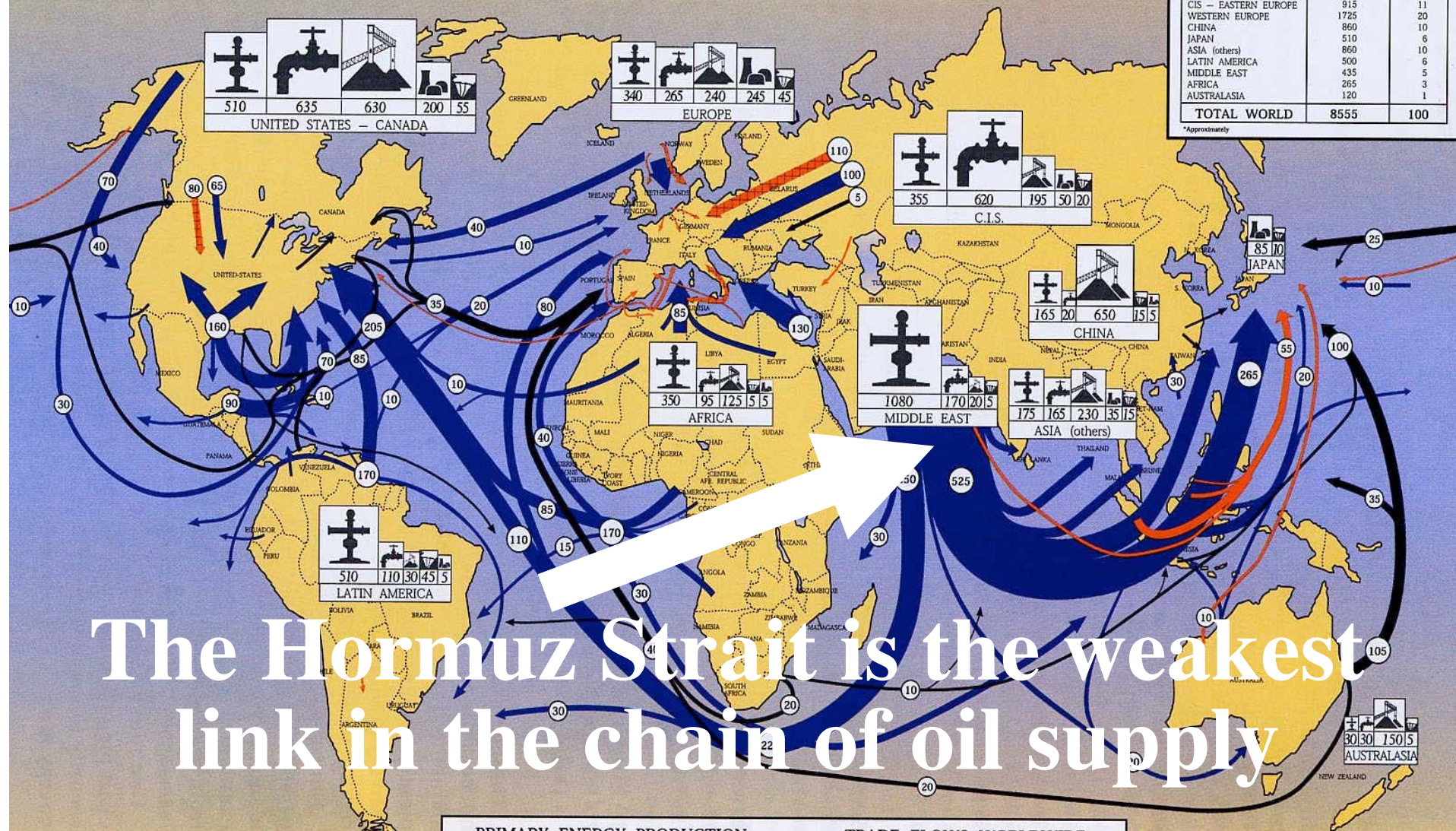


# ENERGY WORLDWIDE IN 1998

70% of the world's oil supply comes from the Middle East with all its geopolitical implications

PRIMARY ENERGY CONSUMPTION*		
(Commercial energy only) (Million tonnes oil equivalent)		
Areas	Consumption	Share (%)
UNITED STATES – CANADA	2365	28
CIS – EASTERN EUROPE	915	11
WESTERN EUROPE	1725	20
CHINA	860	10
JAPAN	510	6
ASIA (others)	860	10
LATIN AMERICA	500	6
MIDDLE EAST	435	5
AFRICA	265	3
AUSTRALASIA	120	1
<b>TOTAL WORLD</b>	<b>8555</b>	<b>100</b>

\*Approximately



The Hormuz Strait is the weakest link in the chain of oil supply

## PRIMARY ENERGY PRODUCTION

(Million tonnes oil equivalent)



\*1000 kWh = 0.26 toe for nuclear production  
\*\*1000 kWh = 0.085 toe for hydroelectricity

## TRADE FLOWS WORLDWIDE

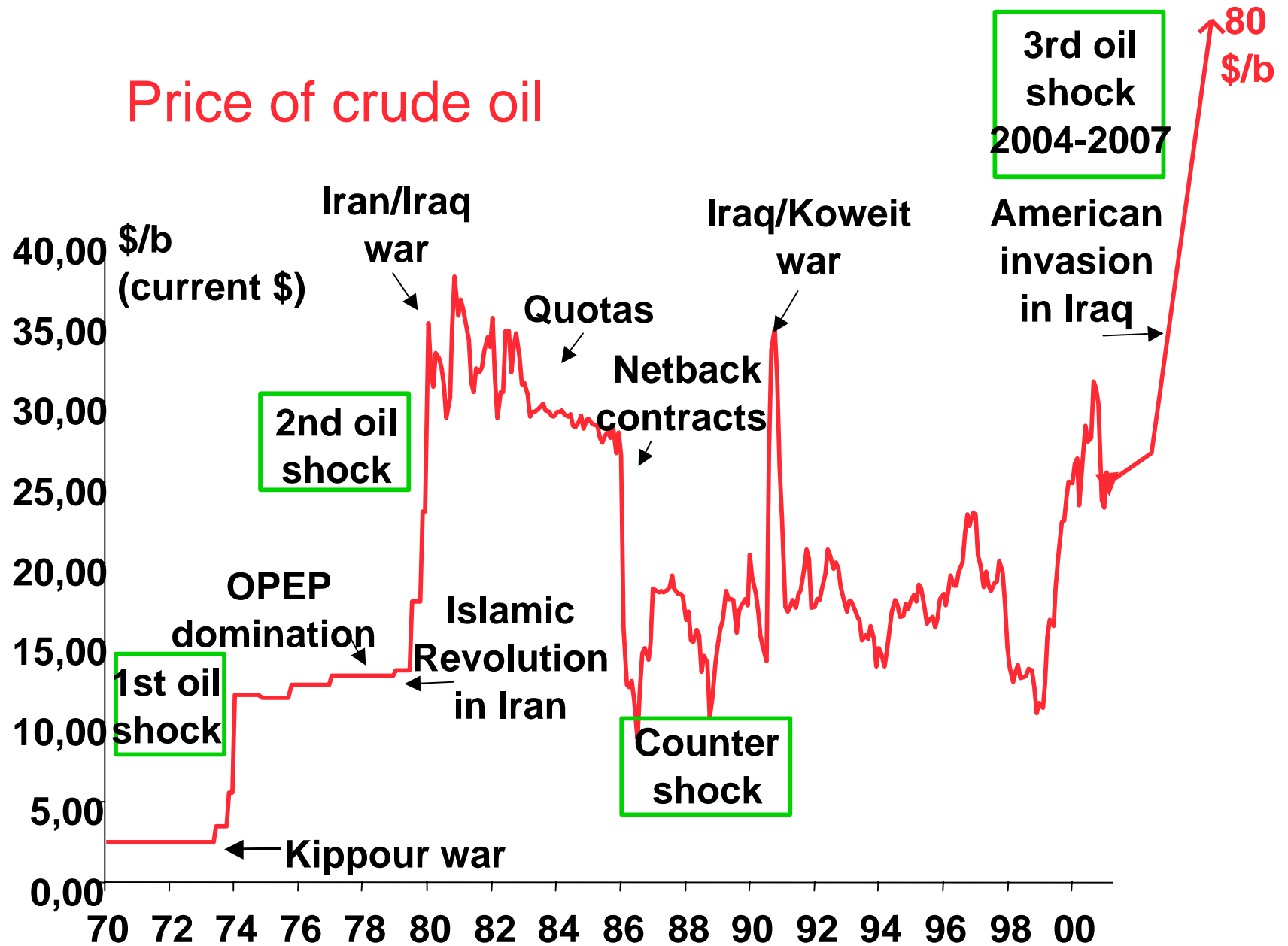






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## Price of crude oil

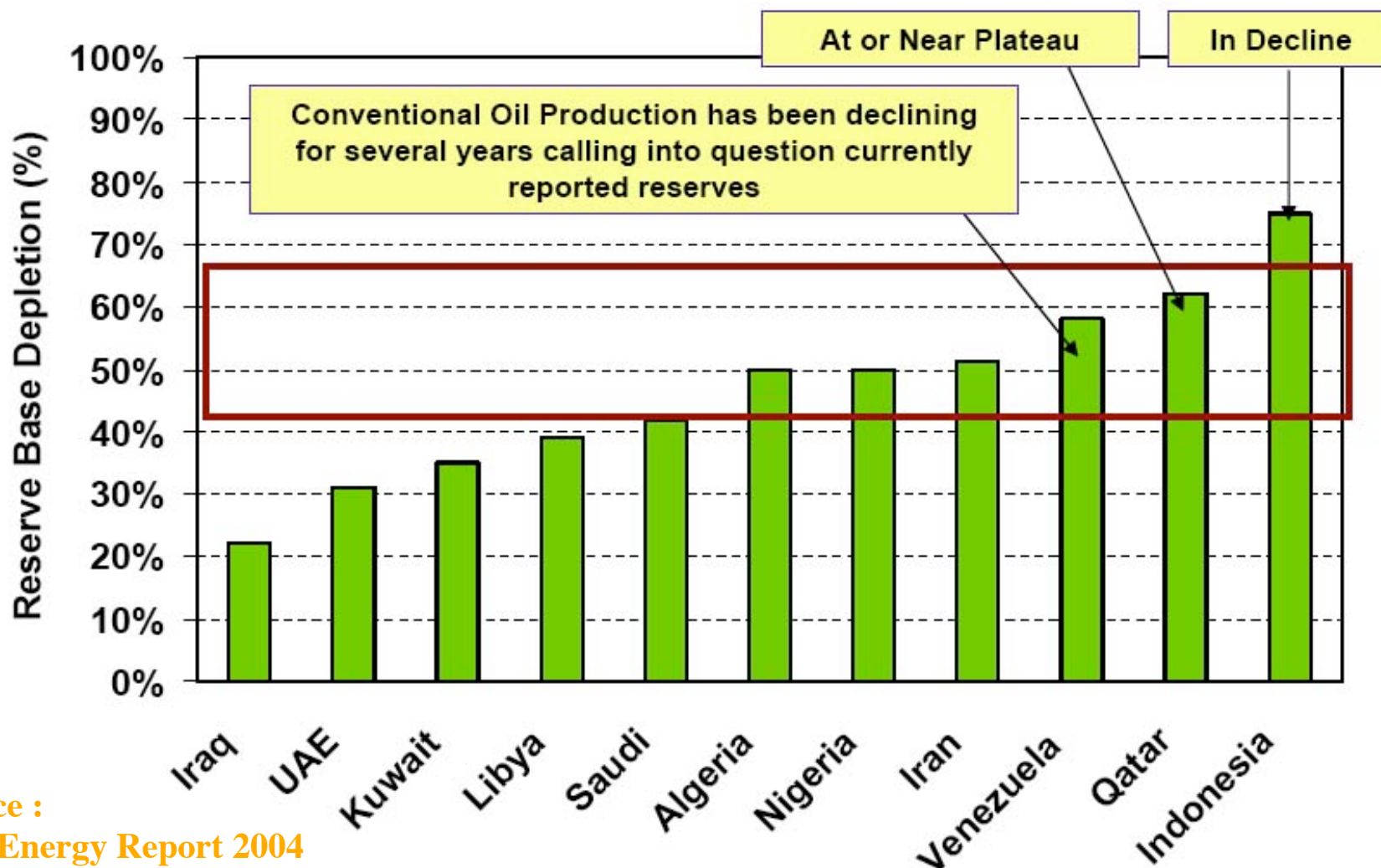


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# OIL PRODUCTION PEAK IS IMMINENT - OIL PRODUCTION WILL START DECLINING SOON



Source :  
PFC Energy Report 2004

# GreenHouse Gas Effect

20<sup>th</sup> century : +0.5 to 1°C

21<sup>st</sup> century : +3 to 10° C

Let 's suppose... : we stop emitting greenhouse gases today, what happens with global warming ?

**A GLOBAL EFFECT with a long time constant : URGENT action is required.**

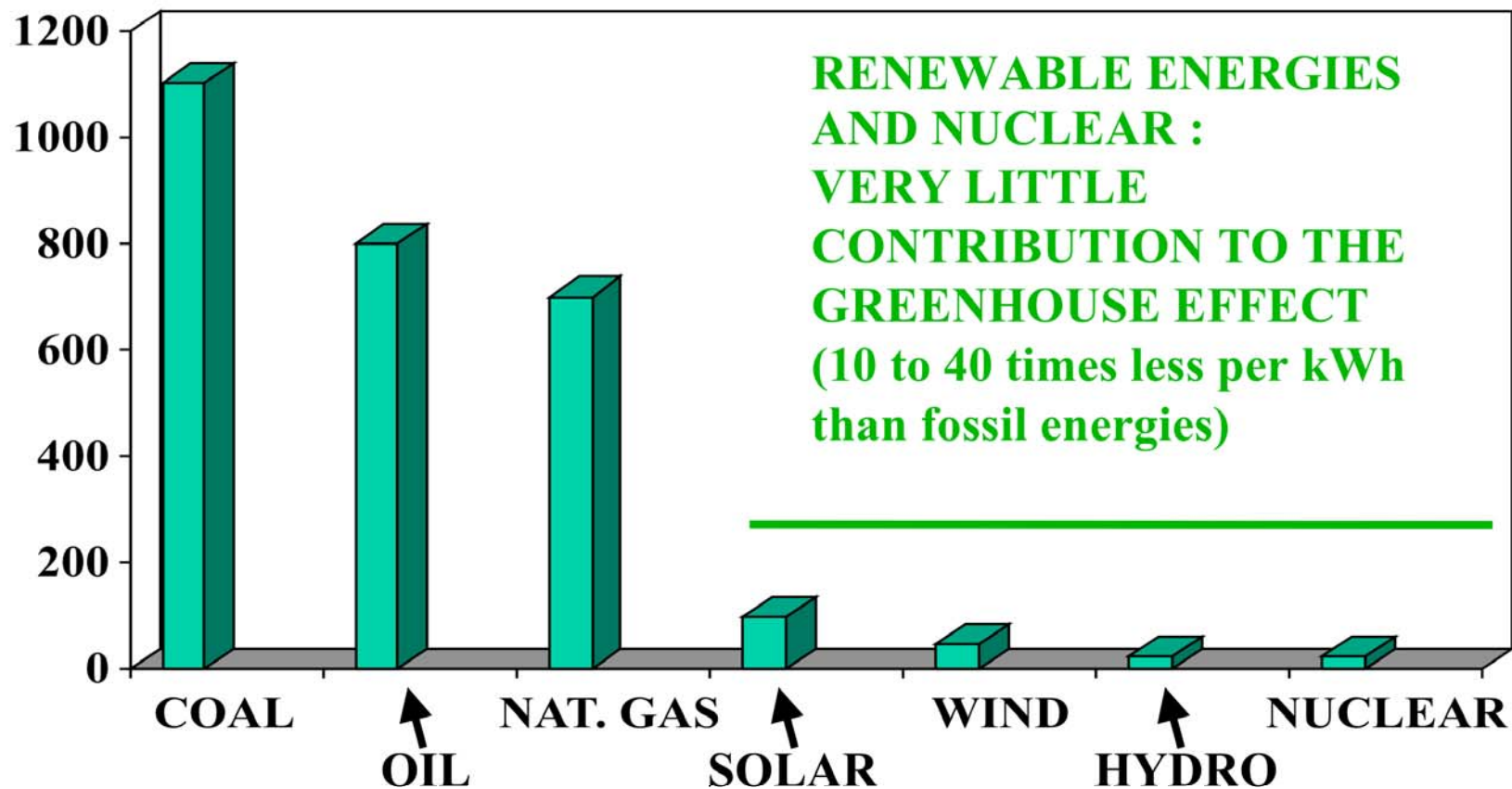




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# GREENHOUSE GAS EMISSIONS OF VARIOUS ENERGY SOURCES

gr CO<sub>2</sub>/kWh



Ref: NEW 01/96



# WHAT CAN WE DO ?

**1 - ENERGY CONSERVATION**

**2 - ENERGY EFFICIENCY**

**3 - CLEANER ENERGIES**

In 20 years divide in developed countries:

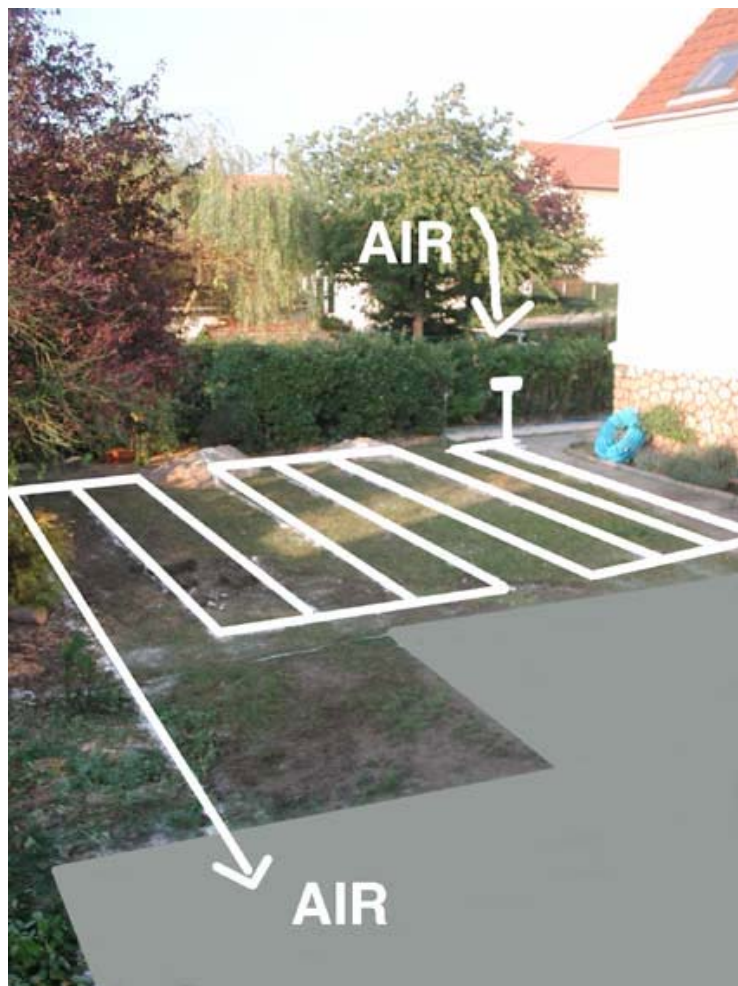
- energy consumption by factor 2
- CO2 emissions by factor 4.





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# Pre-heated air + free air conditioning







# Construction Technology

- Better insulation
- Efficient materials
- Pre-heated air
- Heat-pump
- Double-flux ventil.

-> **Consumption divided by 10**

-> **CO2 emissions divided by 100**

**Compared to a standard home.**





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Cleanova - L.I. SVE-Dassault-Heuliez -  
2007 Tout élect 200 k ou hybride 500 km

# Clean transports



Bluecar - Bolloré - LMP( $\div 3$ vol $\div 5$ kg - 200km)  
10 ans - rech 6 h - 20kE - 125 km/h - 2008

- Make the right choices
- train, public transports
- electric vehicles
- electrify (clean)



« I » Mitsubishi - 400 km - 2010



# Clean electricity

- ban carbon for electricity production
- leaves us with :
- renewables
- nuclear

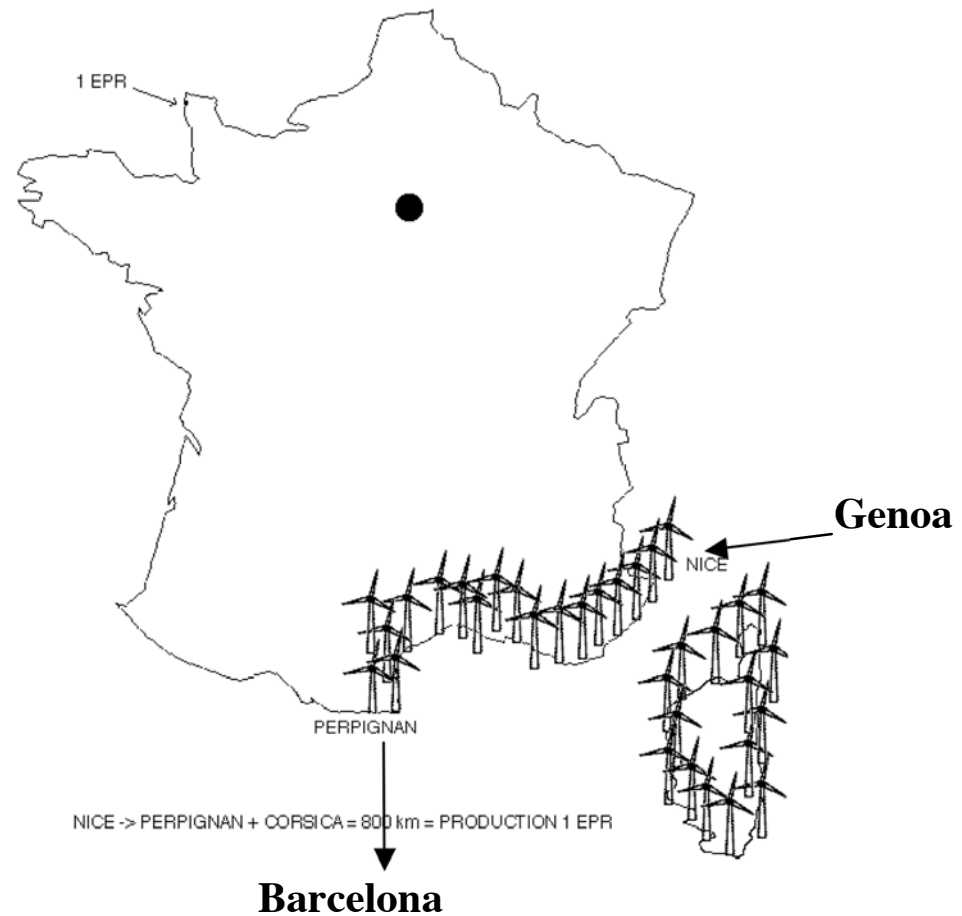






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# WIND ENERGY CAN HELP, BUT WILL NOT SAVE THE PLANET

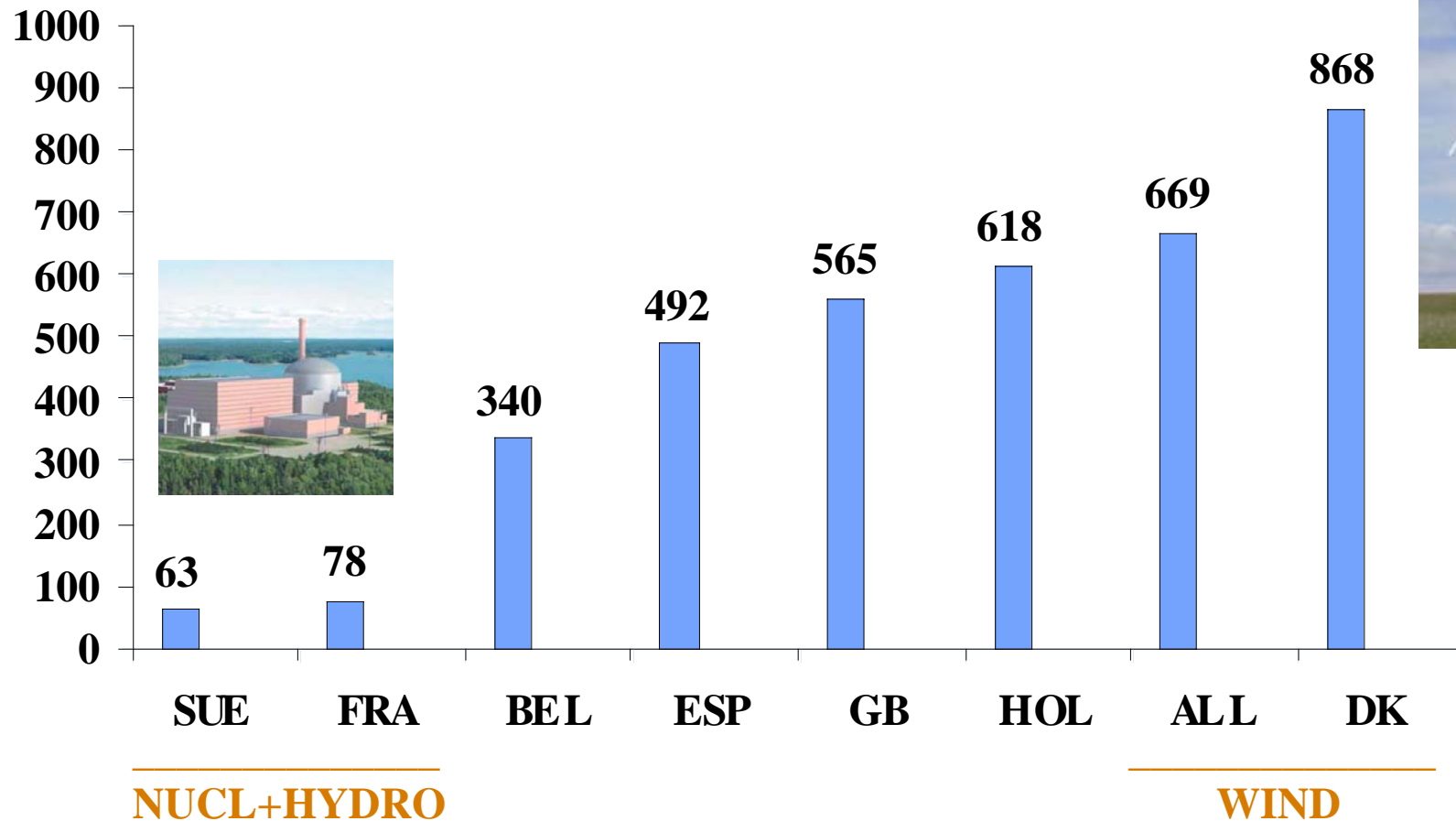




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# **CO2 EMISSIONS IN EUROPE**

**(TONS of CO2 /GWh)**





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# SOLAR ENERGY CAN HELP A LITTLE, BUT IS NOT ENOUGH





# NUCLEAR ENERGY



- Is quite compact
- Factor 1 million  
(1g U = 1 Ton oil)
- Consumes very little uranium  
(20 T=1m<sup>3</sup> per year)
- Produces very small volumes of waste

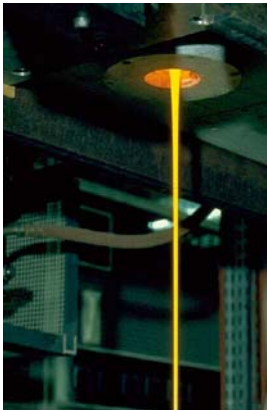


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# **NUCLEAR WASTE IS NOT A PROBLEM**



- **The volume of the waste is small**
- **Nuclear waste is confined - not rejected**
- **Nuclear waste decays spontaneously**



- **Initial toxicity decreases very rapidly**
- **Few meters of earth stops the radiation**
- **Used fuel can be reprocessed**



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# Radioactivity is natural



Airplane : 5  $\mu\text{Sv}/\text{hour}$

In Guarapari (Brazil) :

up to 50  $\mu\text{Sv}/\text{hr}$  on beach

In Ramsar (Caspian Sea) :

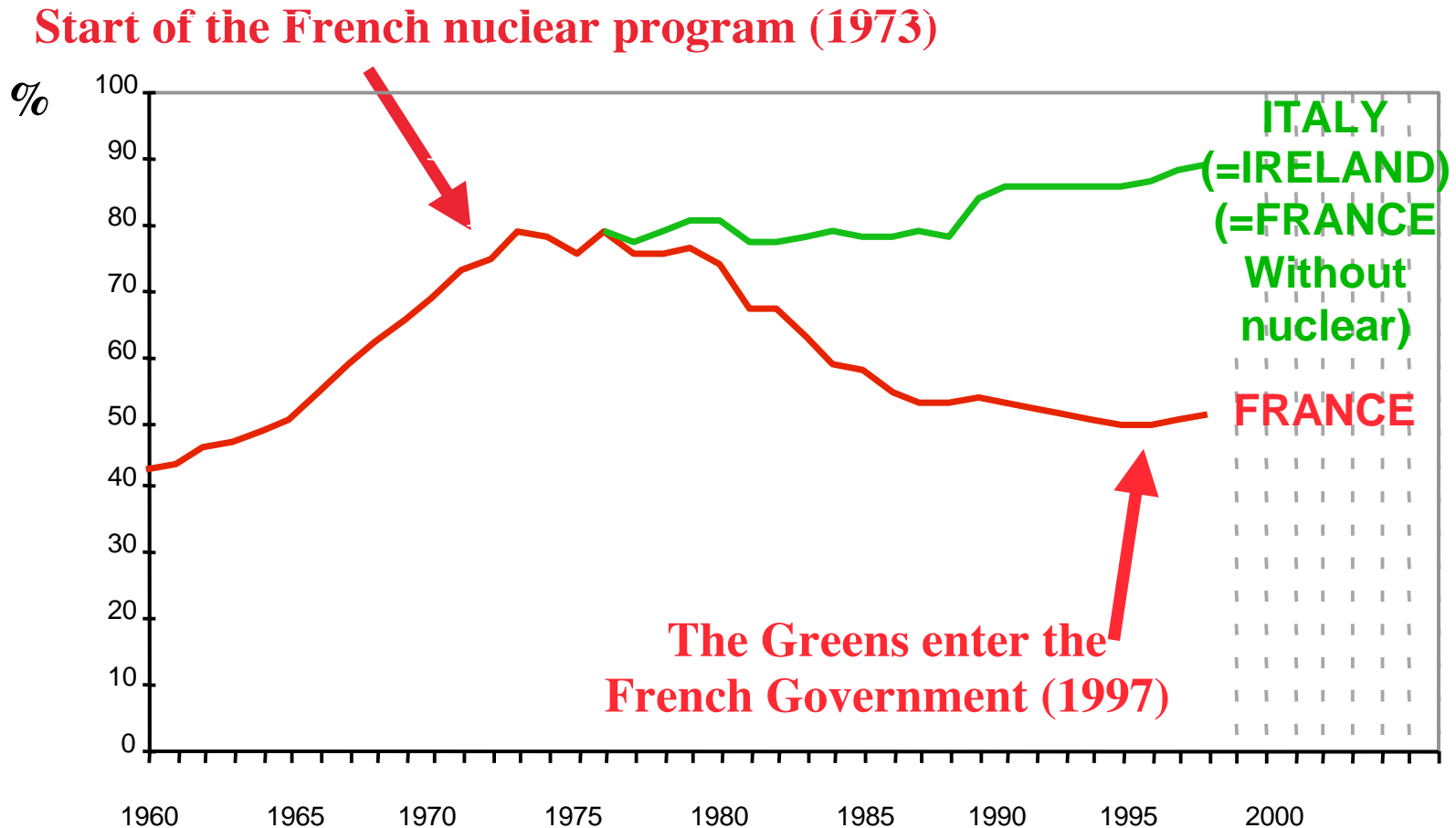
up to 150  $\mu\text{Sv}/\text{hr}$  in houses







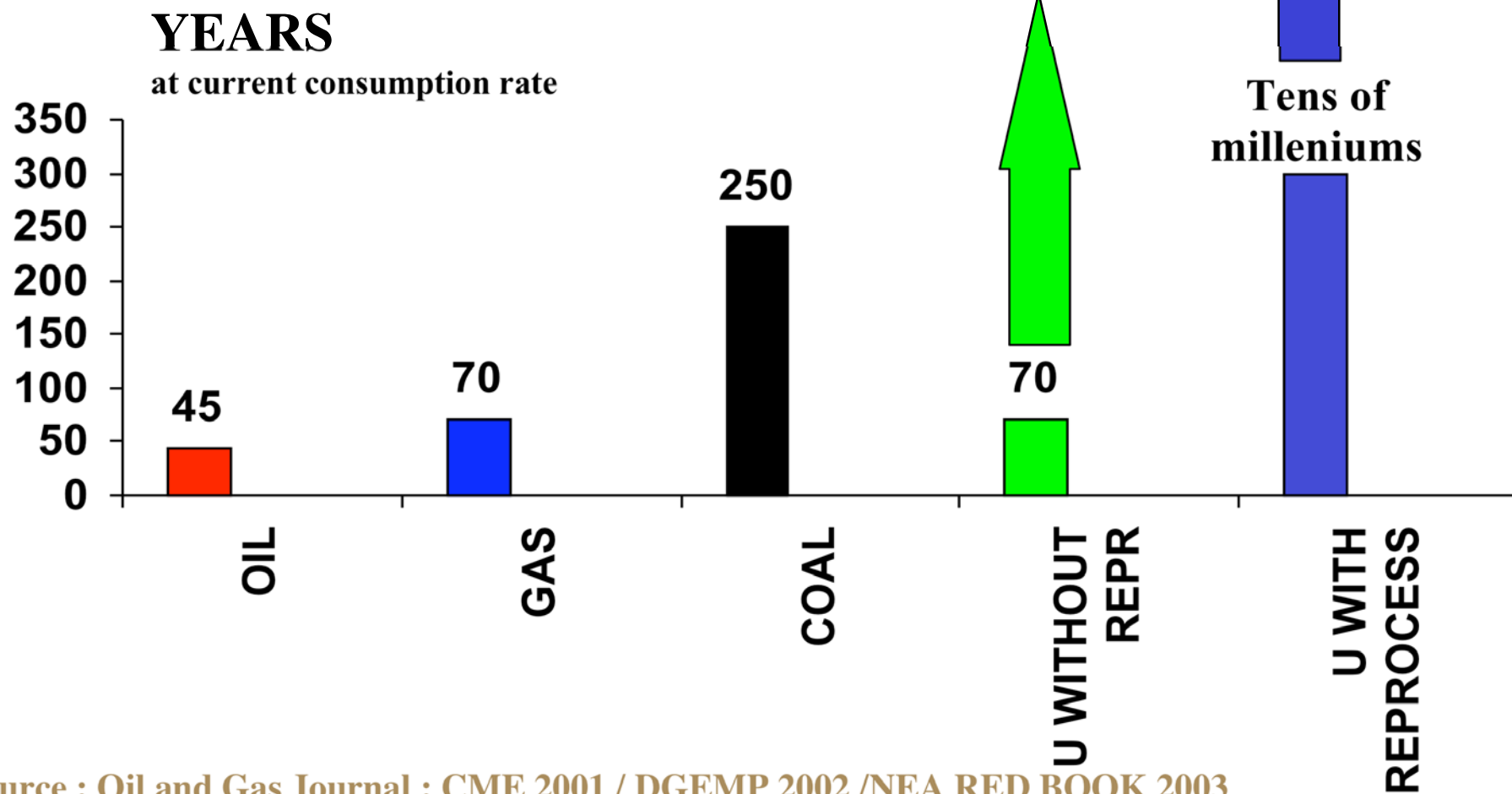
# Energy dependence (%)





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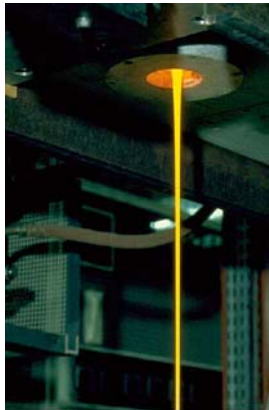
# PROVEN RESERVES



Source : Oil and Gas Journal : CME 2001 / DGEMP 2002 / NEA RED BOOK 2003



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**Will nuclear  
energy play  
a role in  
Ireland ?**





# How many reactors ?

	TWh/yr	reactors	sites
France :	470	58	19
Ireland :	25	3	1



# Time frame for the first reactor

3 years : studies, paper work,  
regulatory framework, public hearings

5 years : construction

Grid connection : 2015



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# Schedule for a complete Irish nuclear program (phase I)

France : 2-3 reactors/year x 26 years

Ireland : 1 reactor/1 or 2 years

Phase I completed by : 2020

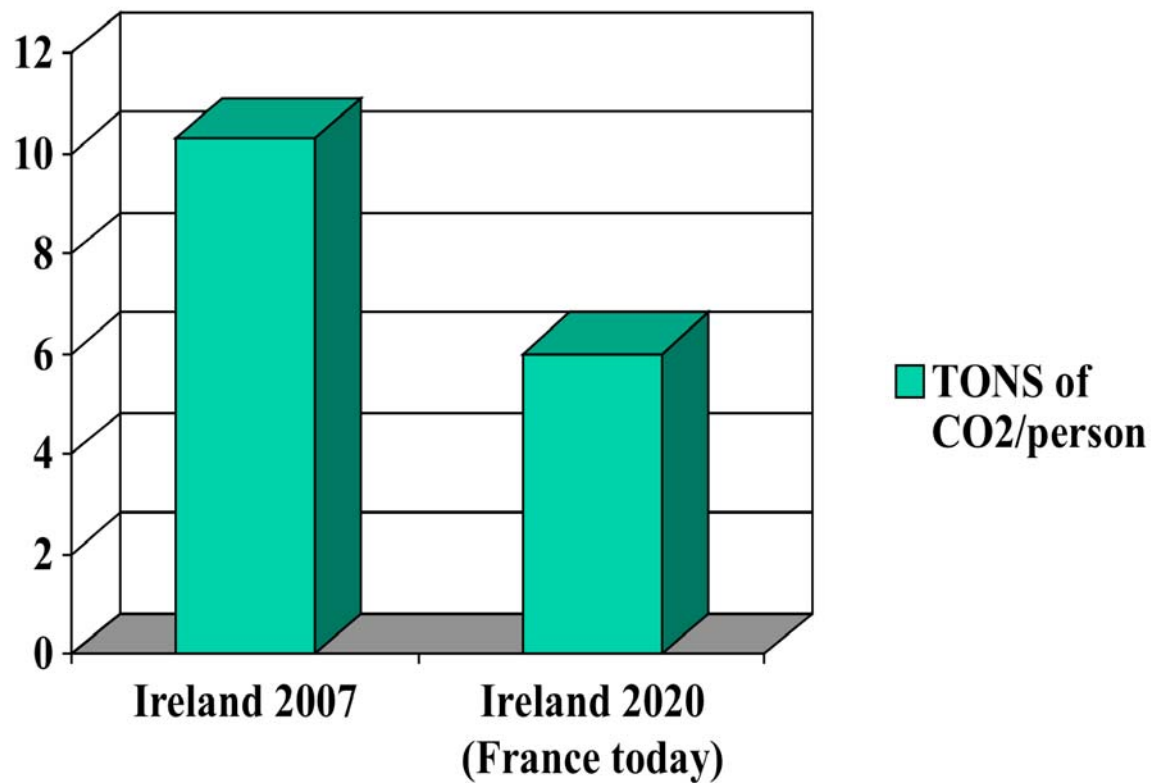
Type of reactors : generation 3 or 3+





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# CO<sub>2</sub> reductions (phase I)





# Medium term (phase II)

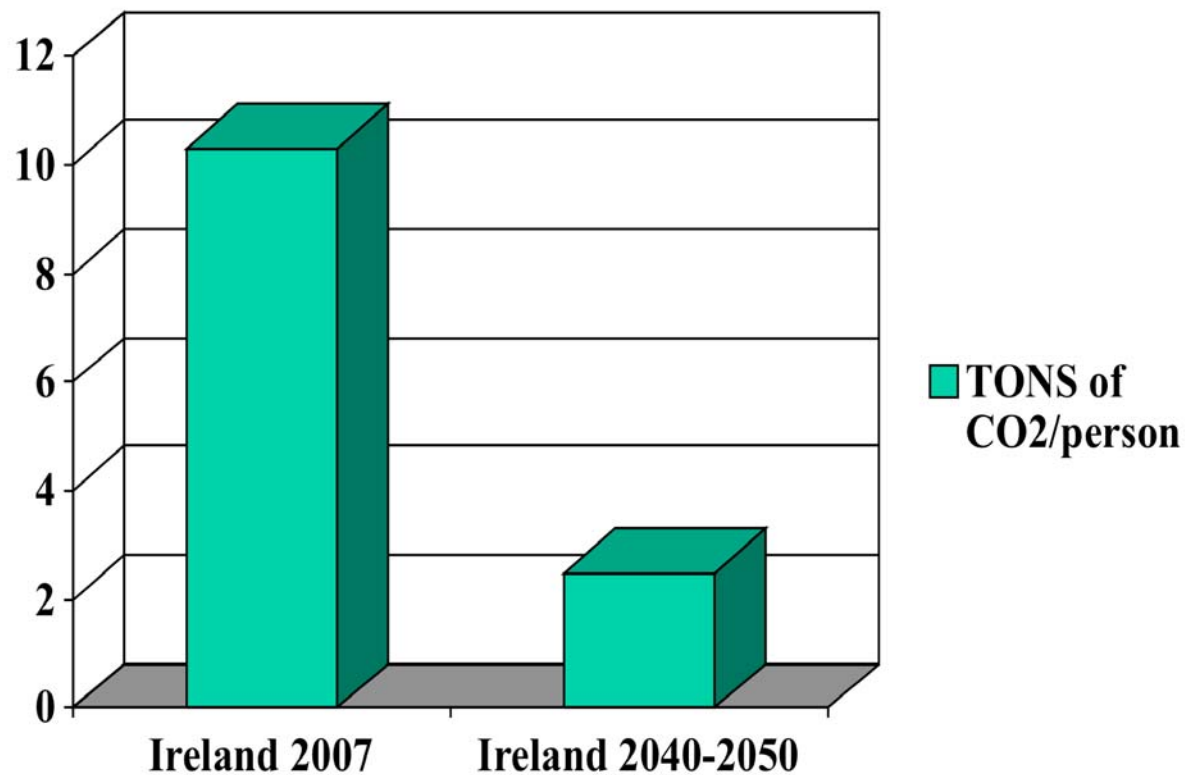
The end of oil and gas : moving transportation, home heating and industry out of its dependence on carbon fuels implies increased use of clean electric power (even with priority to energy conservation).

**2025-2040 : energy needs in Ireland met by  
renewables (hydro, wind, tidal)  
+ 5-6 GW of nuclear reactors on 1 or 2 sites  
Type of reactors : G3+ or G4**



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# CO<sub>2</sub> reductions (phase II)







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# Which reactors for Ireland ?

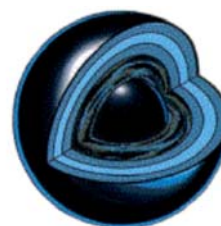
- **Phase I : 2015-2020**

- French 900 MW
- AP-600 or 1000
- ACR-700
- ATMEA 1100
- Japanese ABWR...



- **HTR reactors :**

- PBMR, GT-MHR...



- **Phase 2 (generation 4)**

- Resources x 100, Less waste
- 6 concepts (SFR, LFR, GFR, VHTR, MSR, SCWR)





# Which method for a successful Irish nuclear program ?

- US method : each reactor is different, every piece of every reactor is of a different origin (cost killing)  
(final cost is unpredictable, always higher)
- French method : a coherent standardized program, best if developed in close partnership with an experienced nuclear country.  
Cost : 30-40 Euros/MWh



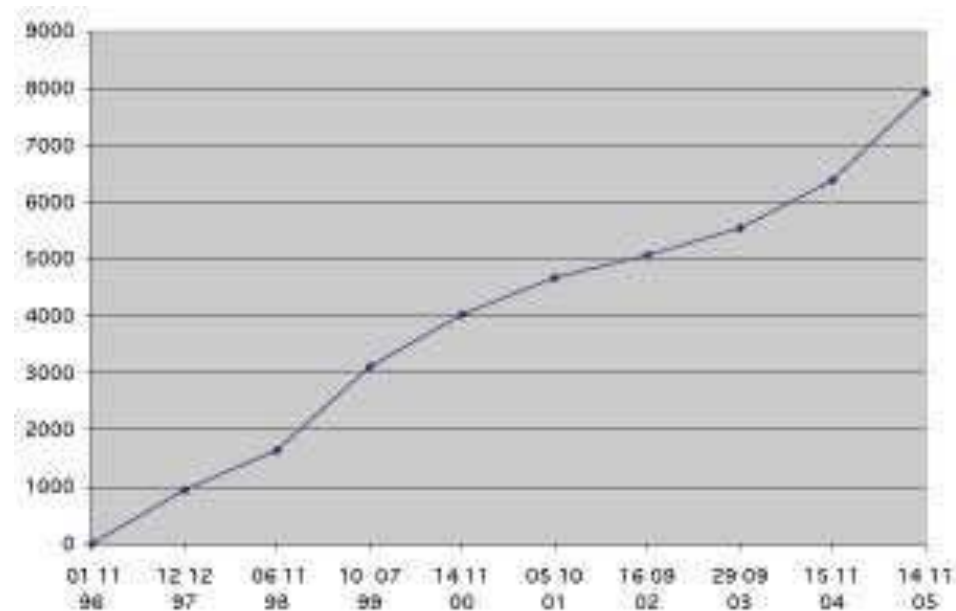
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# EFN : Environmentalists For Nuclear Energy



- An international organization gathering over 9000 members and supporters in favor of clean nuclear energy
- Growing rapidly
- In 56 countries
- On all 5 continents.



**EFN's mission :**  
**information about energy and the environment**

[www.bene.ie](http://www.bene.ie)

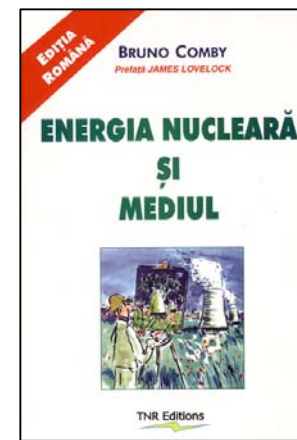
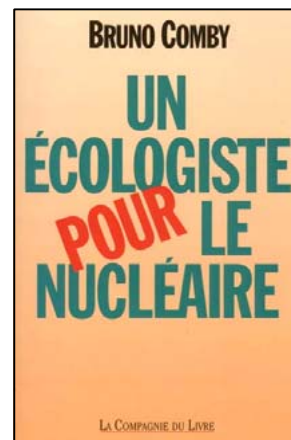
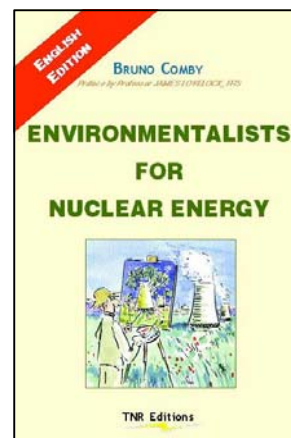
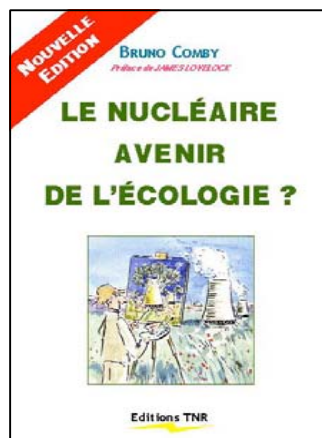
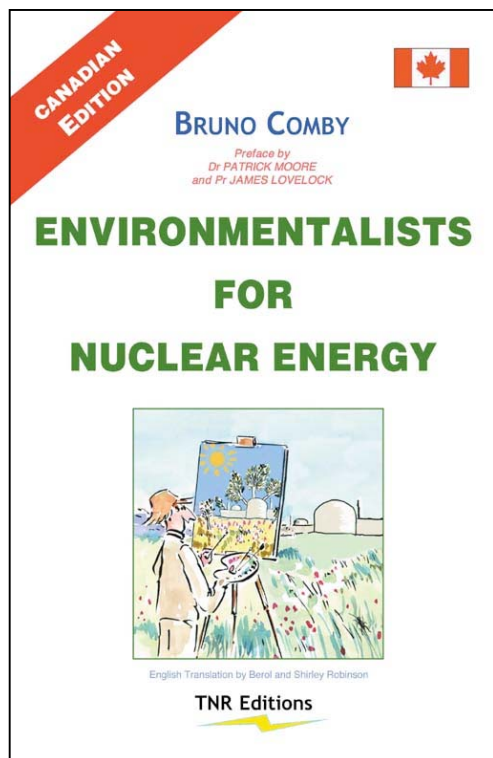
[www.ecolo.org](http://www.ecolo.org)



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# The book:

Bruno Comby's books have informed over one million readers on ecology and the environment published in French, English, Japanese...



Preface by Pr. James Lovelock  
and Dr. Patrick Moore

[www.comby.org](http://www.comby.org) -> click on « books »





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## Pr. James Lovelock

- **Historical father of environmental thinking since the 1960 's**
- **author of the Gaia theory**
- **member of EFN**

**« Nuclear energy is THE ONLY ecological solution »**

“ The dangers of continuing to burn fossil fuels as our main energy source (...) threaten not just individuals but civilization itself (...) I hope that it is not too late for the world to emulate France and make nuclear power our principal source of energy.” (in his preface to Bruno Comby's book)



# Other Environmentalists For Nuclear (members of EFN)

Patrick MOORE, EFN-Canada 

Founder of Greenpeace, former President of Greenpeace-Canada and  
director of Greenpeace international, Honorary chairman of EFN-CANADA



Bishop Hugh MONTEFIORE, UK

Former member of the Board of Friends of the Earth

Yumi AKIMOTO 

Survivor of Hiroshima explosion

GuI GOKTEPE

Award of UN Black Sea Medal  
environmental prize



**CONCLUSION :  
A MAJOR ENERGY CRISIS IS  
DOWN THE ROAD**

**THE WORLD NEEDS ENERGY  
CONSERVATION, RENEWABLE  
ENERGIES AND CLEAN  
NUCLEAR ENERGY**

